

TRANSPORTATION PROBLEMS

HOW NEW YORK IS SPENDING ITS MILLIONS.

Three Classes of Work, Elevated, Surface and Subway. All in the Plans for Better and Faster Handling of Both the Freight and Passenger Traffic.

The opening of the Erie Canal in 1825 diverted the great flow of wheat traffic of the middle West from its former channels, the St. Lawrence and Chesapeake Bay routes, to the Hudson River and made New York city the national port of entry and centre of export trade. The resultant growth of the city in extent and in population made necessary the establishment of some means of local transportation. Stage coaches were introduced in 1830, the first line running between Bowling Green and Blooming Street.

Two years later the New York and Hudson River Railroad Company opened a horse car railroad—the first in this country—running from Prince Street northward through the Bowery and Fourth Avenue to Fourteenth Street.

The tracks were flat iron bars spiked to wooden ties cut from the dense woods a few miles further north. The cars were designed by John Stephenson and closely resembled the stage coaches then in extensive use. The driver sat on a high seat overhead and operated the brakes with his feet.

This primitive method of transportation did not prove to be successful financially and the motive power was changed to steam. The line was then extended west to Harlem Village (1837) and later to Chatham Four Corners.

The era of horse street cars did not really begin until the '50s. The Sixth and Eighth Avenue companies were chartered in 1851, and the Second Avenue, the Third Avenue and the Ninth Avenue companies in 1852.

The Elevated Lines and What They Did. The first elevated railway was completed in 1868. It extended only from City Hall to Cortlandt Street on Greenwich Street and consisted of a single car operated by an endless chain driven by stationary engines. In 1871 the endless chain was superseded by a locomotive and the elevated structure was extended to Third Street, Sixth and Ninth Avenue.

Meanwhile other similar lines were being built, and by 1880 the Ninth, Sixth, Third and Second Avenue roads were in operation.

The opening of all these elevated lines led to the longitudinal development of Manhattan, that is, its growth from south to north, rather than to its symmetrical lateral expansion to east, west and north. The peculiar configuration of Manhattan Island, its length out of proportion to its width, and the existence of the North and East rivers—two great natural barriers that made New York and Long Island difficult of access—were the underlying causes for the northward growth of transportation lines, and the lack of extension east and west.

These unique conditions so complicated the problem of providing for increased traffic that in 1875 the State Legislature passed an act authorizing the appointment by the Mayor of New York of a special board or commission that would devote all its time and energy toward providing adequate means of transportation.

In 1890 the Rapid Transit Board came into existence. In 1907 it was succeeded by the Public Service Commission appointed by Gov. Hughes.

The Public Service Commission. The old Rapid Transit Board proved unsatisfactory only because it did not have power enough. It had the right to authorize new routes but did not have the authority actually to construct them. It could recommend future improvements and advise the correction of existing abuses, but lacked the power to order its recommendations or suggestions carried out.

The Public Service Commission, on the contrary, has the right to command railway corporations to make such changes as it may deem necessary and furthermore has behind it the authority to enforce its orders.

The first New York subway, the present Fourth Avenue route, was planned in 1897 by William Barclay Parsons. It consisted of a double track road under Broadway from the Battery to City Hall and a four track road from City Hall northward beneath Elm Street, Fourth Avenue, Forty-second Street and Broadway to Ninety-sixth Street. Here it divided into two double track branches, the West Side division, which continued up Broadway, and the East Side division, which ran beneath Central Park to Lenox Avenue and under the Harlem River to 149th Street, where transfers were given to the Third Avenue elevated line.

Just beyond the 149th Street station the rapid transit road left the tunnel and mounted an incline to an elevated structure on which it ran along Westchester Avenue, Southern Boulevard and Boston Road as far as Bronx Park.

In January, 1899, bids for the construction of the subway were opened, and John B. McDonald's proposition to dig the tunnel for \$25,000,000, with \$2,700,000 extra for stations, was accepted. In March of the same year work was commenced.

avenue to Bath Beach, Bensonhurst and Coney Island.

In October, 1907, the Public Service Commission authorized the construction of the Fourth Avenue route and drew up detailed plans. In May, 1908, the commission received bids for the construction of the proposed road in six sections, at a total cost of about \$15,000,000.

Before the Board of Estimate could take official action to appropriate the money necessary it was served with a taxpayer's injunction sworn out by Jefferson J. Leary on behalf of Comptroller Metcalf. This injunction prevented the board from awarding the contracts to the successful bidders until the exact state of the city's debt incurring capacity had been determined. The debt limit question is now in the hands of Benjamin F. Tracy. Meantime actual construction is held up pending his decision.

The Broadway-Lexington Route.

The Broadway-Lexington Avenue route favored by the Public Service Commission embodies four or five of the nineteen routes originally outlined by the Rapid Transit Board. As amended it extends from the Battery through Church and Vesey Streets, Broadway, Tenth Street and Lexington Avenue to the north bank of the Harlem River. Here it divides, one branch running northeast to Pelham Bay Park, the other northwest along Jerome Avenue to Woodlawn.

The so-called Tri-Borough subway is a proposed line planned by Chief Engineer Rice of the old Rapid Transit Board. It extends through Pelham Bay Park, through Westchester Avenue and Southern Boulevard, under the Harlem River, down Third Avenue and the Bowery to and across the Manhattan Bridge, under Flatbush Avenue extension, Ashland Place, Fourth Avenue and Fortieth Street to Coney Island. The Brooklyn portion of the Tri-Borough route coincides with the proposed Fourth Avenue subway. The Bronx portion coincides with one branch of the Broadway-Lexington Avenue line.

The Centre Street loop is intended to provide a connecting link between the three East River bridges. It is a four track subway extending from the Delancey Street end of the Williamsburg Bridge through Centre Street to a terminal directly below the proposed municipal building at the end of the Brooklyn Bridge. A two track spur runs through Canal Street to the Manhattan Bridge. Elevated trains that cross the Williamsburg Bridge have their terminus below ground on the same level as the loop now building. The terminal of the Manhattan Bridge will be similarly arranged.

The Manhattan terminal of the Brooklyn bridge was reconstructed some time ago to permit of the physical connection of that structure with the underground loop. This arrangement will permit the Brooklyn Rapid Transit Company to run its elevated trains over one bridge through the subway loop and back to Brooklyn over one of the other two bridges, providing an endless chain that can handle an enormous volume of traffic with ease and celerity.

Two Great Improvements.

Of the many great engineering undertakings now under way on Manhattan Island the two greatest are the improvement projects of the Pennsylvania Railroad and of the New York Central. The Pennsylvania is spending \$100,000,000 in realizing the dreams of its former president, A. J. Cassatt.

The railroad has three objects in view. First, it desires an accessible terminal in the heart of New York City instead of one remotely situated on the west bank of the Hudson River and connected with downtown Manhattan by means of an unreliable ferry service; second, it wishes to obtain control of Long Island, an undeveloped territory of great natural wealth; third, it aims to connect with the New York, New Haven and Hartford Railroad system and so establish an all rail route between New England and the South and West. These three are the leading considerations; there are a great many minor issues more or less obvious.

To carry out its plans the Pennsylvania has been obliged to conduct the following: The construction of a tunnel from New Jersey to Long Island City, consisting of two single track iron tubes beneath the North River, two double track tubes under Manhattan Island and four single track tubes beneath the East River; the erection of vast terminal buildings above the main sub-surface station between Seventh and Ninth Avenues, Thirty-first and Thirty-third Streets; the establishment of terminals at Harrison, N. J., and Jamaica, L. I., where the change from steam to electricity will be made; the building of a connecting viaduct and bridge from the terminal building in Long Island City across the East River to Randall's Island; the extension of the New Haven Road, with a roundabout extension through East New York to Bay Ridge for freight traffic; the elimination of grade crossings on Long Island and the electrification of the subway divisions of the Long Island Railroad.

Trials Trains Late This Year.

The tunnels have been dug, lined with iron plates and stiffened with a concrete jacket two feet thick. They will be ready for trial trains late in 1909 and will be opened officially in the spring of 1910. The steel work of the Manhattan terminal has been erected and most of the stone work set in place. The excavation of the Sunnyside yard in Long Island City is almost completed and preliminary work on the Jersey terminal is progressing rapidly. The delivery of passenger and freight stations of the L. I. R. at Flatbush Avenue were completed some time ago. Electric trains now are operated between this station and Hempstead, Valley Stream, Far Rockaway and Rockaway Beach. The Long Island City division is being connected with the Rockaway division by means of the Glendale cutoff.

The Pennsylvania proposes to electrify in the near future the two double track divisions between Jamaica and Long Island City, the Manhattan Beach division, the North Shore division running from Westchester Avenue to the Long Valley Stream and Garden City, the Long Beach division. An appropriation already has been made for electrifying the Long Beach division and the work will be begun this spring. After these lines have been completed the Oyster Bay branch will be electrified and the Montauk division equipped with the third rail as far as Babylon.

In addition to the electrification of its suburban service the New York Central and Hudson River Railroad has planned and is carrying out several stupendous undertakings whose total cost has been variously estimated at from \$50,000,000 to \$75,000,000. The general scheme of improvement calls for the removal of all grade crossings, the depression and increase of the number of its tracks, the enlargement of its freight and passenger yards and the erection of a new terminal building which will be the largest and

most elaborate structure of its kind in existence.

Tunnel to Be Improved.

From Fifty-seventh Street southward in the Park Avenue tunnel the roadbed will be depressed and will spread out to accommodate ten tracks instead of the four in present use. The four inside tracks of the proposed ten will be used as a main line entrance to the enlarged upper yard, two tracks will be used for switching and the outside four for suburban trains, which will occupy a separate lower level. The upper level for through trains will have sub-tracks, while the lower level will have a double track loop at its south end and near Forty-third Street connecting with the tracks of the Fourth Avenue underground road.

The depression of the roadbed permits the extension of Park Avenue for its full width along a steel viaduct above the enlarged yard from Fifty-fifth to Forty-fifth Street and the connection by east and west viaducts of the ends of streets between Forty-fifth and Fifty-fifth streets now separated by the terminal. Much of the work has already been completed. On the east side of the yard a large area has been excavated to the final level and the greater part of the steel work installed.

The Central has completed the electrification of its suburban tracks as far north as Mount Vernon on the Harlem division and Yonkers on the Hudson River division. An electrified suburban service now is in operation between these two points and Grand Central Station. Ultimately the electric zone will be extended to White Plains and Croton-on-Hudson. No steam locomotives now enter the Grand Central Station or run through the Park Avenue tunnel south of the Harlem River. Through trains are coupled to powerful electric locomotives at High Bridge, below which point steam is entirely replaced by electricity as a motive power.

Suburban trains are operated under the multiple unit system, that is each car contains its own motive power and may be run independently. This method is the one adopted by the subway and elevated roads. Trains for points within the present electric zone on the New York Central leave the temporary terminal under Lexington Avenue.

The New York, New Haven and Hartford Railroad is now operating motor drawn trains between Grand Central Station and Stamford, Conn. Suburban trains running to points between Stamford and New Haven and through trains to Boston and other cities still further east are drawn by steam locomotives. Eventually the electric service will be extended to Bridgeport and New Haven. Between Grand Central Station and Woodlawn, at which point the New Haven road branches off from the New York Central and bears off to the eastward, power is supplied to the motors by a third rail. Above Woodlawn contact is made with a heavily charged overhead wire.

Harlem Branch Improved.

The Harlem branch of the New Haven road has been equipped with six tracks and is now being electrified. Several new stations have been built between the terminal at Willis Avenue and 133d Street and the point of intersection with the main line at New Rochelle. An agreement has been made with the Pennsylvania Railroad whereby through trains from Boston and from other points in the East will run over these tracks across the New York Connecting Railroad bridge to Astoria, whence through the Pennsylvania tunnels in the heart of New York City instead of one remotely situated on the west bank of the Hudson River and connected with downtown Manhattan by means of an unreliable ferry service; second, it wishes to obtain control of Long Island, an undeveloped territory of great natural wealth; third, it aims to connect with the New York, New Haven and Hartford Railroad system and so establish an all rail route between New England and the South and West. These three are the leading considerations; there are a great many minor issues more or less obvious.

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The Erie Railroad's plan for transit improvement includes a new terminal in Jersey City, a four track tunnel through Bergen Hill and ultimately the electrification of its suburban service. The present two track tunnel through Bergen Hill accommodates, in addition to the main line trains, the New York, New York, Northern Railroad of New Jersey, the Newark branch and the Greenwood Lake division. The New York, Susquehanna and Western now uses the Pennsylvania terminal in Jersey City. Under the present arrangement the existing two track tunnel has to be used for freight as well as passenger traffic. The new four track tunnel will be used for passenger service only. Freight traffic will then be handled entirely by the old two track tunnel.

The six tracks now in use will be merged into four tracks west of Bergen Hill. Two of these tracks will be used under ordinary conditions for westward traffic and two for eastbound traffic. During the morning and evening rush hours three tracks will be used in one direction and one for the lighter traffic going the other way. The Susquehanna will move from the Pennsylvania station to the new Erie terminal and will use the old route of the Greenwood Lake division across the Hackensack Meadows near Snake Hill. The tracks of the Newark branch will run north and east across the meadows from Newark on a newly acquired 100 foot right of way that connects with the Greenwood Lake branch over a new bridge across the Hackensack River.

Bergen Hill Tunnels.

Bergen Hill will be penetrated by a series of tunnels alternating with open cuts for a length of 4,500 feet. The new bore is situated a short distance south of the old tunnel. The railroad tracks will be placed above the present level at Palisade Avenue and will reach a common grade at Hudson County Boulevard. The new terminal station will be set back for a considerable distance from the waterfront in order to permit trains to connect with the McAdoo transverse tunnel from Jersey City to Hoboken.

Passengers on the Erie will thus have access to Manhattan through the North River tunnels at Morton and Cortlandt Streets. It is estimated that the new tunnel, electrification and terminal will cost \$20,000,000, of which the cost of the terminal alone is \$8,000,000. The tunnel work probably will be completed by fall. The "McAdoo tunnels," as they are

popularly known, include four single track iron tubes grouped in pairs and extending beneath the Hudson River from New Jersey to Manhattan. The northern pair extend from the Hoboken terminal of the Lackawanna Railroad to the foot of Morton Street, New York, thence under Greenwich Street, Christopher Street and Sixth Avenue to a terminal at Thirty-third Street. Intermediate stations are at Christopher and Greenwich Streets and at the intersection of Sixth Avenue with Ninth, Fourteenth, Nineteenth, Twenty-third and Twenty-eighth Streets. A spur is to be constructed through Ninth Street from Sixth Avenue to Fourth Avenue, connecting the New Jersey tunnel with the Manhattan subway.

The north tubes were completed in January, 1908, and regular service was inaugurated on February 25 from Hoboken to Nineteenth Street. A short time later the service was extended to Twenty-eighth Street. The south tubes of the McAdoo system extend from Jersey City under the North River and up Fulton and Cortlandt Streets to Church Street, where a big terminal building occupying two entire blocks has been built.

One of the south tubes has been dug and the other will be bored through shortly. It is expected that trains will be running through both tunnels by July 1. Ultimately the south tubes will be connected with the Interborough subway by means of a short extension through Deey Street to Broadway.

More Than \$400,000,000 to Be Spent.

Besides the under river tubes a transverse tunnel is being built that will run north and south along the west bank of the Hudson and will connect the McAdoo system with the terminals of the Lackawanna, Erie, Pennsylvania and Jersey Central railroads. Altogether the new transit scheme will cost between \$300,000,000 and \$700,000,000, including the downtown terminal and office building.

This is the third attempt to tunnel the Hudson River. In 1874 D. C. Haskin, a civil engineer, worked out a plan for constructing a brick tunnel from Hoboken to New York, the tunnel being lined with iron plates and the New Jersey bank lines into Manhattan, with a terminal station near Washington Square. The Hudson River Tunnel Company was formed to carry out the Haskin plan and did construct 1,200 feet of the tunnel, some under each shore and a little under the river. Difficulties of construction that could not be overcome were encountered. The company failed and in 1880 the work was abandoned.

In 1880 the firm of Pearson & Son, the constructors of the East River section of the Pennsylvania tunnels, undertook to continue the Haskin tunnel, backed by English capital. But this company also dropped the work after adding 1,800 feet to the Haskin tunnel. Pearson & Son used compressed air in their work, and that is said to have been the first time compressed air was used in horizontal underground construction although it had been used in mining shaft work. The Pearson plan also was to provide a tunnel to bring locomotive drawn passenger trains into New York.

In 1902 William G. McAdoo organized a company which took over the work of the two predecessors. His idea was to use electric cars to accommodate all of the Hudson River passenger traffic through two sets of tubes. A construction company was formed, known as the Hudson Companies, of which Walter G. Oakman is head. Mr. McAdoo became president of the operating company, called the Hudson and Manhattan Railroad Company. The engineering work was undertaken by Charles M. Jacobs as chief and J. Vipond Davies as deputy engineer.

The financial end of the operation was handled by Pliny Fisk and William H. Barnum of the banking house of Harvey Fisk & Sons. This combination has accomplished the scheme that twice before had fallen through. The plan for the mammoth terminal station developed later on, when it was realized that passenger traffic would ultimately be exceedingly heavy.

The Belmont Tunnel.

The Belmont, or Steinway, tunnel had its origin in a scheme started in 1887 to operate a tunnel railroad under Forty-second Street, Manhattan, from Eleventh Avenue to the East River, and thence to City with certain branches to other points in the Borough of Queens. The length of the tunnel was to be five and a half miles. The company was incorporated in that year as the New York and Long Island Railroad.

In December, 1890, it got permission from the New York Board of Aldermen to carry on construction. In January, 1891, the State Legislature granted permission for work under the East River and in October, 1891, the Common Council of Long Island City gave the necessary consent for work on that side of the river. Work was stopped in 1892 because of a damnable fire in the Long Island City shaft in which several workmen were killed and hurt. A great deal of damage was done to neighboring houses.

In 1904 August Belmont bought the franchise of the road and effected compromises with those who held claims against the old company. Work was resumed in 1905. Legal complications between the city and the railroad developed almost from the start, affecting the franchise rights and the length of the term of grant.

The city contended that the franchise expired in 1907. The court, however, declined to uphold an injunction restraining the road from carrying on the work, holding that the difficulty should be settled by a suit. Borings were completed early in 1907 and the steel was ordered. The road was to have been put in operation in June of the same year, almost two years ago. Meanwhile the legal complications remained unsettled.

Early in 1908 the Belmont interests approached the Public Service Commission with a proposition to sell the road to the city, the city to convey the road on behalf of the municipality, made application to the Legislature in March, 1908, for an extension of its powers. A bill therefore was introduced at Albany permitting the purchase, but not stipulating terms or manner of procedure, subject to the approval of the Board of Estimate and Apportionment. Gov. Hughes signed the bill on May 22, 1908.

Tunnel Matter in Abeyance.

Since then, owing to the condition of the city's finances and the uncertainty as to the debt limit, the matter has been held in abeyance, although the Belmont interests have made two other propositions to the Public Service Commission for the purchase of the tunnel and its operation. As completed the tunnel extends from Park Avenue and Forty-second Street, adjoining the Grand Central Station, to and under the East River to Fourth Street, Long Island City. A

small terminal station has been built on the south side of Forty-second Street, 100 feet west of Third Avenue, on the site of one of the shafts used while actual construction was going on.

The tunnel contains two tracks connected by a narrow loop at Forty-second Street and Park Avenue that permits cars operating in the tunnel to swing around and return to Long Island City. This loop was designed for the use of trolley cars such as those now in use on the Queens county trolley lines, controlled by the Belmont interests. As the engineers of the Public Service Commission point out in their recent report upon the proposition of the tunnel company to dispose of the tube to the city, the loop is at present too narrow to permit the operation of trains made up of several cars or the operation of single cars of the subway type.

Shortly before reaching Third Avenue the twin under river tubes widen out and unite to form a single large chamber. In the area between the in and the out-bound tracks west of Third Avenue a station is placed similar to the platforms at express stations in the Manhattan subway. Above the platforms is a mezzanine floor reached from below by a number of stairways. From the mezzanine floor, two escalators or moving stairways operate side by side, each with a carrying capacity of 10,000 passengers an hour. The escalators are at right angles to the tracks and have an exit within the sidewalk line. They are so arranged that in rush hours both may be operated in the same direction.

The tunnel is far below the surface, the top of the tube being over fifty feet beneath the street level at Park Avenue. The tracks are at least fifteen feet further down. The unusual depth of the tunnel is due to the sharp dip made in order to pass under the bed of the East River and also to the steep grade of Forty-second Street westward from the riverfront. This great depth will prevent interference of the Belmont tube with future subways projected by the city.

The New York and Long Island Railroad is now operating motor drawn trains between Grand Central Station and Stamford, Conn. Suburban trains running to points between Stamford and New Haven and through trains to Boston and other cities still further east are drawn by steam locomotives. Eventually the electric service will be extended to Bridgeport and New Haven. Between Grand Central Station and Woodlawn, at which point the New Haven road branches off from the New York Central and bears off to the eastward, power is supplied to the motors by a third rail. Above Woodlawn contact is made with a heavily charged overhead wire.

Freight Problem.

The question of the removal of the steam railroad tracks of the New York Central from the surface of Eleventh Avenue and the substitution of a freight subway has an important bearing upon the transportation problem that faces New York City. The Public Service Commission has been impressed with an idea that seems to be increasingly favored by competent authorities, that the solution of the West Side track problem must have relation to the general betterment of freight distribution in the entire city and especially in the Borough of Manhattan. Merely to build an expensive railroad to perform the same work that is now being performed by the surface tracks would not decrease the expense of the freight handling. The plan that will permit of adoption should lessen the cost of handling freight instead of increasing it.

One of the drawbacks to the commercial prosperity of the city is the great expense of handling freight. The amount of freight trucking is constantly increasing. Merchants are complaining because of the time taken and expense incurred in delivering goods from and delivering them to the railroads and shipping lines. The enormous use of the street for freight purposes is a serious obstacle to passenger transportation. Surface cars on some of the streets cannot transport the number of passengers that they should.

Wilgus's Plan.

William J. Wilgus, former chief engineer of the New York Central Railroad and at present head of the Amsterdam Corporation, has presented a plan for an improved system of freight distribution throughout Manhattan that has favorably impressed the Public Service Commission. Briefly outlined the plan is to lay out a general freight yard on the Hackensack Meadows, which freight consigned to this city shall be transferred to small cars and run by electric power through a tunnel under the North River and then into an underground belt line encircling the waterfront of Manhattan Island, with branches to all the important railroad and steamship docks.

These small freight subways would be connected with the trunk lines terminating in New York and also by means of the Hudson River tunnels with all the main railroad lines terminating in New Jersey. At each connection with these main lines freight would be transferred to small cars, which it would not be removed until placed at the door or within the warehouse of the consignee. Although the small subways would not in the beginning reach all business houses and freight handlers, yet as the system increased nearly all might be approached.

Those responsible for this plan assert that it would be practicable to remove the car bodies from the small cars and without disturbing their contents carry them by horse or mechanical power to the warehouse of the consignee.

At recent public hearings on the Wilgus plan a number of other plans were presented. Congressman Charles N. Fowler of New Jersey filed a plan by which deep freight subways might be operated by an air current or electricity. The Merchants Association presented a plan for an elevated freight railroad and suggestions were made by various organizations, such as the Reform Club and the City Club.

The East River Bridges.

At the present time there are four bridges spanning the East River and connecting the western end of Long Island with Manhattan. Taken in order from south to north they are the Brooklyn Bridge, the Manhattan Bridge, the Williamsburg Bridge and the Queensboro or Blackwell's Island Bridge. The first three are suspension bridges, that is, the framework of the bridge proper is supported by great cables made up of a multitude of fine wires. The Queensboro Bridge is a cantilever structure, which means that its tracks and roadways are held up by steel trusses.

The Brooklyn and Williamsburg bridges have been in operation for some time. The Queensboro Bridge will be ready for traffic in a few weeks. The Manhattan Bridge still is under construction. It is expected to be completed by January, 1910. A fifth bridge across the East River, known as the New York Connecting Railroad Bridge, has been planned, but as yet its actual construction has not been undertaken. It will join the Bronx terminal of the New Haven Railroad with the Long Island City terminal of the Pennsylvania Railroad.

The old Brooklyn Bridge, the granddaddy of all East River bridges, reaches from Park row, Manhattan, to Sands and Washington Streets, Brooklyn. It completed its twenty-fifth year of service on May 24, 1908. The bridge was begun on January 3, 1870, and was opened for foot passengers on May 21, 1883. The cable road was put in operation on September 24 of the same year, and on July 1, 1888, was leased to the elevated railroad interests now merged in the Brooklyn Rapid Transit Company.

250,000 a Day.

The first day the cable road was operated it carried 8,528 passengers. This was considered an enormous rush. Today it is estimated that at least 250,000 persons cross the Brooklyn Bridge daily, carried by elevated trains and by the three or four thousand trolley cars that cross the big span during every twenty-four hours. Practically from that time, and increasing up to the present, the "bridge crush" has been a serious problem for city officials and a source of extreme discomfort and inconvenience to residents of Brooklyn.

Minor improvements have been made from time to time, but only recently has any serious effort been made to abate the nuisance and to provide a fairly adequate accommodation for the throngs which travel back and forth across the bridge every day. The overcrowding of the Brooklyn Bridge was due in the past to two important defects in the transit scheme. One of these defects was that the Brooklyn Bridge formed the only means of communication between Manhattan and Brooklyn outside of the inadequate ferry service. The other was that the limited space of the bridge and was of necessity used as a terminal, where outgoing and incoming streams of passengers were brought face to face within narrow confines. The result has been a congestion equalled probably nowhere else in the world.

Some slight deflection of traffic from the Brooklyn Bridge was accomplished four years ago by the opening of the Williamsburg Bridge. The opening of the Brooklyn extension of the subway in February, 1908, also tended partly to ameliorate conditions at the Park row terminal. The effect of the opening of these two new lines of transit, however, was only temporary. The increasing population has once more swelled the bridge crush to its old proportions. The only hope of permanent relief lies in the Manhattan Bridge and the Centre Street subway loop now building. They will be completed by January 1, 1910.

Temporary Relief Measures.

Meanwhile temporary measures have been adopted. The elevated tracks have been extended across Park row to City Hall Park, longer trains have been put in service and through cars have been run across the bridge at all times. Under the old regime the antiquated cable cars were run across the bridge during morning rush hours, but now they have been discontinued. The roadway and the footpath. Later, when it was seen that there would eventually be a heavy flow of traffic across the bridge, the plans were altered to permit the construction of two additional elevated tracks. It now appears from a report of a body of engineers who examined carefully the big structure recently that only two of the elevated tracks can be operated with safety.

The New York Connecting Railroad, a subsidiary of the Pennsylvania Railroad, filed plans with the Municipal Commission on May 22, 1907, for its huge East River bridge, in accordance with the provisions of the charter granted to the company. The new structure will be the heaviest steel bridge in the world. It will be purely a freight bridge and will contain four sets of tracks, two for passenger and two for freight traffic. The bridge will sweep in a graceful curve over Hell Gate, Ward's Island, Little Hell Gate, Randall's Island and the Bronx Kills, connecting Port Morris in the Bronx with Astoria, Long Island City.

There will be a steel arch span of more than a thousand feet across Hell Gate between abutments. The stone towers will be of granite and moulded concrete and will be over 200 feet high. The carrying capacity of the new bridge will be about twenty times greater than that of the old Brooklyn Bridge. The relation of the Connecting Railroad to the New Haven and Pennsylvania systems has been referred to in the preceding article. The Hendrick Hudson Memorial Bridge, for which two sets of plans were drawn, is proposed to span the Harlem Ship Canal from Inwood, Manhattan, to Spuyten Duyvil Hill in the Bronx and to connect the extension of Riverside Drive with Spuyten Duyvil Parkway. When the bridge was first discussed in 1903 it was thought that it would be completed this fall in time for the celebration of the tricentennial of the discovery of the Hudson River. The original estimated cost was \$600,000. This sum was appropriated in 1905 and plans for the structure were accordingly drawn up. The first set of plans was approved by the Board of Estimate and Apportionment in 1907. A new set of plans was drawn in 1907, revised plans call for a masonry structure that will cost in the neighborhood of \$10,000,000.

The project for the establishment of a bridge across the Hudson River to connect New York City with New Jersey first took definite shape in February, 1906, through appointment by the Governors of the two States of a joint commission to consider the practicability of the plan. The first report of this commission was handed in a year later. It recommended a suspension bridge situated between Fourteenth and Forty-second Streets with piers inside the bulkhead line. The cost of the bridge and its anchorage was estimated at about \$30,000,000. It did not include the cost of approach.

A second report by the commission, submitted in December, 1908, outlined three sites, Fifty-seventh Street, 110th Street and 170th Street. Of the three the 170th Street site is considered the most satisfactory. The commission's engineers estimate the cost of a bridge at this point at about \$10,000,000.

The first memorial life to be built in this country for the carrying of passengers will be constructed this spring over the three mile stretch of the old City Island horse path connecting City Island with the Bartow station of the New Haven Railroad in the Bronx. Permission for the building of the line was granted by the Public Service Commission last fall. Behind the enterprise is the American Memorial Company, a concern in which Bion L. Burrows and other members of the old Rapid Transit Commission are financially interested. If the short stretch of the road to City Island proves successful it will be extended throughout the Bronx and lower Westchester county.

street subway loop already referred to and the opening of the Flatbush Avenue extension in Brooklyn.

At present the Public Service Commission's plans are shrouded in mystery. Brooklyn elevated and trolley lines cannot obtain access to the Manhattan Bridge until the Flatbush Avenue extension is opened, graded and paved. The extension cannot be graded until sewers, gas and water mains and conduits have been laid. These sub-surface improvements cannot be installed until the first two sections of the proposed Fourth Avenue subway are built.

Plan Suggested in 1898.

The plan for a bridge across the East River to relieve congestion on the Brooklyn Bridge was suggested by Bridge Commissioner Shea to the Board of Public Improvements on January 12, 1898. Mayor Van Wyck submitted a plan for this bridge to the board on November 30, 1898, and on December 2, 1899, the Bridge Commission forwarded plans for a wire cable suspension bridge for the Secretary of War. Construction was authorized in January, 1900. Work was begun in May, 1901. Title to the land was acquired by the city on September 14, 1901. Differences of opinion over types of construction and because of legal obstructions caused a delay between 1901 and 1904. They finally were settled and contracts were let.

Most of all foundations for the towers were constructed, reaching down to hell rock, 100 feet below the surface of the river. Masonry piers then were built and the steel towers erected. Meanwhile the granite anchorages were constructed. The four suspension cables have been spun from a multitude of fine wires and the suspension ropes supporting the steel superstructure have been spun in place. The framework of the bridge proper will be placed together by June, 1909. The roadway will be constructed, the tracks laid and the electrical equipment installed. The bridge will be ready for traffic by January, 1910.

The Queensboro or Blackwell's Island bridge crosses the East River and Blackwell's Island, connecting the Borough of Manhattan from a point on Second Avenue between Fifty-ninth and Sixtieth Streets, with the Borough of Queens at Janss Street, Long Island City. Ground for the structure was broken as far back as 1892, but plans did not reach the Secretary of War until December 2, 1899.

Construction was authorized in 1900 and the first contract was let on June 27, 1901. The spans were joined in March and April, 1909, and the steel superstructure finished on June 1, 1908. This work was delayed six months by strikes. The bridge will probably be opened for traffic some time next month.

The Queensboro Bridge.

The Queensboro Bridge is a cantilever structure consisting of five spans of varying length with a long stretch of steel and masonry approach at each end. The total span of the cantilever section is 3,725 feet. The length of the bridge with its approaches is 8,231 feet. Originally it was planned to equip the bridge with two elevated tracks. In addition to the trolley tracks, the roadway and the footpath. Later, when it was seen that there would eventually be a heavy flow of traffic across the bridge, the plans were altered to permit the construction of two additional elevated tracks. It now appears from a report of a body of engineers who examined carefully the big structure recently that only two of the elevated tracks can be operated with safety.

The New York Connecting Railroad, a subsidiary of the Pennsylvania Railroad, filed plans with the Municipal Commission on May 22, 1907, for its huge East River bridge, in accordance with the provisions of the charter granted to the company. The new structure will be the heaviest steel bridge in the world. It will be purely a freight bridge and will contain four sets of tracks, two for passenger and two for freight traffic. The bridge will sweep in a graceful curve over Hell Gate, Ward's Island, Little Hell Gate, Randall's Island and the Bronx Kills, connecting Port Morris in the Bronx with Astoria, Long Island City.

There will be a steel arch span of more than a thousand feet across Hell Gate between abutments. The stone towers will be of granite and moulded concrete and will be over 200 feet high. The carrying capacity of the new bridge will be about twenty times greater than that of the old Brooklyn Bridge. The relation of the Connecting Railroad to the New Haven and Pennsylvania systems has been referred to in the preceding article. The Hendrick Hudson Memorial Bridge, for which two sets of plans were drawn, is proposed to span the Harlem Ship Canal from Inwood, Manhattan, to Spuyten Duyvil Hill in the Bronx and to connect the extension of Riverside Drive with Spuyten Duyvil Parkway. When the bridge was first discussed in 1903 it was thought that it would be completed this fall in time for the celebration of the tricentennial of the discovery of the Hudson River. The original estimated cost was \$600,000. This sum was appropriated in 1905 and plans for the structure were accordingly drawn up. The first set of plans was approved by the Board of Estimate and Apportionment in 1907. A new set of plans was drawn in 1907, revised plans call for a masonry structure that will cost in the neighborhood of \$10,000,000.